HISTORIC STATUS OF BLACK-FOOTED FERRET HABITAT IN MONTANA

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ABSTRACT.—Black-footed ferrets (*Mustela nigripes*) use prairie dogs (*Cynomys* spp.) for food and their burrows for shelter. Thus, prairie dog colonies are essential ferret habitat. Prairie dog control, which resulted in permanent loss of ferret habitat, is considered the primary reason for the ferret's endangered status today. Northern Pacific Railroad (presently Burlington Northern) lands were surveyed 1908–1914, just prior to the onset of widespread prairie dog control. In Montana the surveyed area included a belt about 483 km long and 192 km wide, from the Montana-North Dakota border westward to Livingston. In all, 6,661 sections (11.8%) of 22 counties were surveyed and 1,662 of these sections (24.9%) contained at least some prairie dogs. Prairie dog colonies (N = 1,985) occupied all or part of 5,186, 16 ha (40ac) parcels and totaled a minimum of 47,568 ha, with a mean colony size of 24.5 ha (2.8% of the landscape in colonies). Two township-wide belt transect samples—T4N and R45E—showed colonies were clumped in distribution. Two areas with large complexes of colonies are illustrated, and each area exceeded an estimated 15,000+ ha. The Tongue River-Otter Creek area had at least 20 complexes, with a mean intercomplex distance of 3.4 km; and the Powder River-O'Fallon Creek area had at least 33 complexes, with a mean intercomplex distance of 2.9 km. Historic land uses were similar to today's uses—grazing and a few crops. Historic prairie dog areas in Montana occupied an estimated 5,953 sq km. An estimated 90+% reduction in prairie dogs has occurred since 1914, largely if not totally due to poisoning. The elimination, fragmentation, and greatly reduced size of ferret habitat has undoubtedly contributed to the endangered status of ferrets. A few areas in Montana appear to contain enough prairie dogs to potentially harbor ferret populations. These areas could serve as reintroduction sites for ferrets, as well as examples of complex prairie dog ecosystems.

Black-footed ferret habitat consists of biotic and abiotic components of prairie dog colonies (Coues 1877, Forrest et al. 1985). In addition to black-footed ferrets, prairie dog colonies host many vertebrate and invertebrate species, some in dependent relationships with prairie dogs, such as the black-footed ferret (Clark et al. 1982). This inter-relationship of plant and animal life centered on prairie dog colonies is often called the "prairie dog ecosystem" (Bureau of Land Management 1980). The ecology of prairie habitats in North America has been significantly altered over the past century because of the activities of man. Prairie dog ecosystems have been greatly affected by extensive poisoning over the last 100 years. As a result, many of these ecosystems were drastically reduced or totally eliminated. Many species dependent on prairie dogs have also suffered. Unfortunately, few data exist on actual prairie dog distribution and abundance prior to post-1915 poisoning campaigns by the Biological Survey and various states. The prairie dog ecosystems of today are perhaps the most notable examples of relict, insular ecological relationships. This is biologically significant because of the large numbers of associated species involved.

An understanding of historic data is essential for efficient management of such relict ecological relationships. This paper describes black-tailed prairie dog (*C. ludovicianus*) status in Montana from 1908 through 1914 and compares it with current knowledge about Montana prairie dogs and black-footed ferret habitat requirements as described in the literature. The historic extent and configuration of prairie dog colonies that determined black-footed ferret population sizes, densities and viability has not been previously described in the scientific literature.

METHODS

Data were derived from Northern Pacific Railway land surveys for 1908–1914. The study area was a belt up to 192 km wide and 483 km long, bisected by the Trans-Montana track, which entered Montana at Wibaux, extended west to Glendive on the Yellowstone

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River, then paralleled the river to Livingston. The Northern Pacific Railway, which formerly owned the Trans-Montana track, merged with other railroads to form the Burlington Northern, Inc., Railway in 1968. The Agricultural Resources Department, Burlington Northern, Inc., Miles City, Montana, provided the original survey data.

In Montana, the Northern Pacific was granted 20 odd-numbered sections of land per 1.6 km (1 mi) of track as inducement to link East to West by rail. Initially lands were selected from a zone 32 km (20 mi) on either side of the track. However, because some sections were previously appropriated to homesteaders or other occupants, the government set a 96 km (60 mi) limit on each side of the track from which to select other sections. Three large exclusions within the 192 km strip were made for Northern Cheyenne and Crow Indian reservations and for high mountainous country. As a land grant railroad, the Northern Pacific partially funded track construction through disposition of some lands granted by the federal government.

Before Northern Pacific sold or leased land grant parcels, range examinations were made to map them and determine their present and potential land uses and existing natural resources, including timber, grass, and water. Prior to 1908, the United States General Land Office had completed land surveys to mark section and quarter corners associated with the Montana Principal Meridian and Standard Parallel. As a result, the railroad land examiners accurately mapped topography, drainages, flatlands, timbered areas, coal outcrops, and other resource characteristics that influenced land value. Because prairie dogs were considered a menace that destroyed rangeland forage and crops, prairie dog colonies were also mapped.

The locations and extent of prairie dog colonies were indicated on original maps by writing "DOGS" or "DOG TOWN" across the occupied area, proportional to the size of the colony. For large colonies, letters appeared bold and widely spaced, and in some cases actual colony sizes were estimated. Often comments were included on prairie dog grazing effects or the spatial extent of colonies. Surveyed lands were mapped and color coded by estimated land use potential—grazing, cropland, and woodlands, which indicated topography and vegetation on which colonies were located. Herman Liebinger (personal communication to Wieland, 1979), land agent of eastern Montana land for the Northern Pacific Railway in the 1930s, was sure that all prairie dog colonies were recorded on all lands examined.

We designed data sheets to record the occurrence of prairie dogs from the original land assessment journals that recorded the sections [2.56 sq km (640 acres)] containing prairie dogs. For each section we recorded a "hit" or a "miss" for prairie dog occurrence. Hits and misses from the data sheets were color coded and plotted on mylar overlays of 1:250,000 USGS topographic maps. These overlays demonstrated the clustering of prairie dog colony distribution. For those sections with prairie dogs, an estimate was made from the maps as to how many 16 ha (40 acre) tracts (16 per section) contained prairie dogs. Furthermore, a given 16 ha tract could have anywhere from a few holes to an entire 16 ha of prairie dogs. We used the midpoint of 8 ha per tract to estimate colony sizes when actual sizes were not given. This gave us an estimate for actual size of prairie dog colonies. Since only odd-numbered sections were surveyed by the railroad, the method constituted a sampling procedure that amounted to a maximum 50% in those townships with complete coverage. Frequently prairie dog colonies extended an unknown distance beyond the boundary of the sample section.

RESULTS

The surveyed area encompasses a large portion of eastern Montana including parts of 22 counties (Fig. 1). The most prevalent land form is rolling sedimentary plains. Erosion coulees, river breaks, badlands, and intrusive mountain ranges are found throughout the area. Precipitation generally ranges from 30.5 to 40.6 cm per year, resulting in a shrub-grass steppe ecosystem. Upland sites support extensive stands of sagebrush (*Artemesia tridentata*) and in some cases juniper (*Juniperus* sp.) or pine (*Pinus* sp.) woodland.

Black-tailed prairie dogs occupy the eastern two-thirds of Montana, or about 220,000 sq km (Hall 1981). Although prairie dog numbers

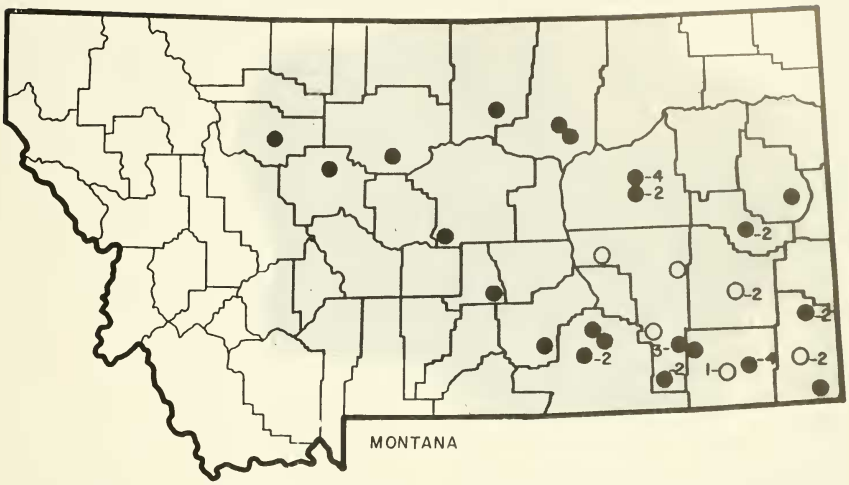


Fig. 1. Range of the black-tailed prairie dog (shaded area) and collection sites of black-footed ferrets (dots) in Montana. Specimens exist for solid circles.

have been greatly reduced, the extent of their overall range has changed little since the early surveys. The belt transect study area included about half of the total prairie dog range, with detailed land examinations of 17,052 sq km, or about 7.8% of the total Montana range of the species. This broad area includes steep terrain, shrubby vegetation, waterways, and intrusive mountain ranges that are not prairie dog habitat. The actual area occupied by prairie dogs throughout this large region was and is limited to relatively level areas, vegetated with herbaceous plants and few shrubs.

General George A. Custer's field journal on his travels to the Little Bighorn River in summer 1876 noted several extensive prairie dog colonies along Rosebud Creek (Fulton 1982). The railroad survey journals also describe many prairie dog colonies in this area. Colony sizes varied: some entries noted only a "few holes" per section surveyed, whereas others stated that a colony was large and extended over adjacent sections (e.g., T16N R45E S21 and to the southwest). We estimated the largest single colony at 9,328+ ha (23,040+ ac) near Beaver Creek and Sweeney Creek south of Hathaway (T4N R44E). Based on many such entries, our assessment of prairie dog distribution should be considered a minimum estimate.

Prairie dog distribution based on the railroad surveys is given by county in Table 1. In the 22 surveyed counties, 6,661 sections within 759 townships were examined, representing 11.8% of the total area of these counties. Of the 6,661 sections, 1,662 (24.9%) were partially or totally occupied by prairie dogs. The largest area was in Rosebud County: of 1,025 sections examined, 397 contained some prairie dogs (38.7%). McCone, Park, Richland, Wheatland, and Wibaux counties all showed less than 10% of the sampled sections occupied by prairie dogs. Big Horn, Carter, Golden Valley, Musselshell, Powder River, and Treasure counties all showed some prairie dogs in more than 40% of the sampled sections. Based on the frequency distribution of colonies by sections, it seems that prairie dogs were relatively abundant and widespread, existing in single large colonies or in large groupings of smaller colonies.

The survey located 1,985 prairie dog colonies or one colony per 3.3 sections (Table 2). These colonies occupied all or part of 5,186 16 ha parcels, totaled a minimum of 475 sq km, and averaged 24.5 ha. Prairie dogs occupied a minimum 2.8% of the landscape.

TABLE 1. Black-tailed prairie dog distribution by county in Montana (1908–1914).

County	Square kilometers	Townships surveyed	Sections surveyed	Percent county	Sections with prairie dogs (%)	Percent 1976 land use[a]			
						Rangelands	Crops	Woodlands	Other
Big Horn	1,946	7	27	0.5	18 (66.0)	84	9	6	1
Carter	1,305	13	146	4.4	59 (40.4)	89	7	3	
Custer	1,475	90	864	22.9	320 (37.0)	92	6	1	
Dawson	927	46	481	20.3	28 (5.8)	72	25		3
Fallon	634	40	321	19.8	51 (15.9)	76	22	1	
Fergus	1,695	3	7	0.2	0 (0.0)	64	20	15	
Garfield	1,754	66	810	18.0	109 (13.4)	93	4	2	
Golden Valley	458	13	164	14.0	69 (42.1)	83	10	5	
McCone	1,026	45	607	23.1	8 (1.3)	70	28		2
Musselshell	731	49	386	20.6	186 (48.2)	71	6	21	
Park	1,041	2	13	0.4	0 (0.0)	49	7	42	
Petroleum	645	15	81	4.9	50 (61.7)	93	4	2	
Powder River	1,284	31	311	9.4	132 (42.4)	84	5	10	
Prairie	677	49	389	22.4	39 (10.0)	88	11	1	
Richland	813	21	197	9.5	12 (6.1)	64	33		3
Rosebud	1,961	127	1,025	20.4	397 (38.7)	90	4	5	
Stillwater	700	8	26	1.4	4 (15.4)	59	20	19	
Sweet Grass	725	20	71	3.8	14 (19.7)	33	18	47	
Treasure	381	16	90	9.2	37 (41.1)	86	9	4	
Wheatland	554	23	225	15.8	5 (2.2)	87	6	6	
Wibaux	347	25	192	21.6	15 (7.8)	65	32	1	
Yellowstone	1,025	50	228	8.7	109 (47.8)	74	18	4	
Totals	22,105	759	6,661	11.8	1662 (24.9)	78	12	9	

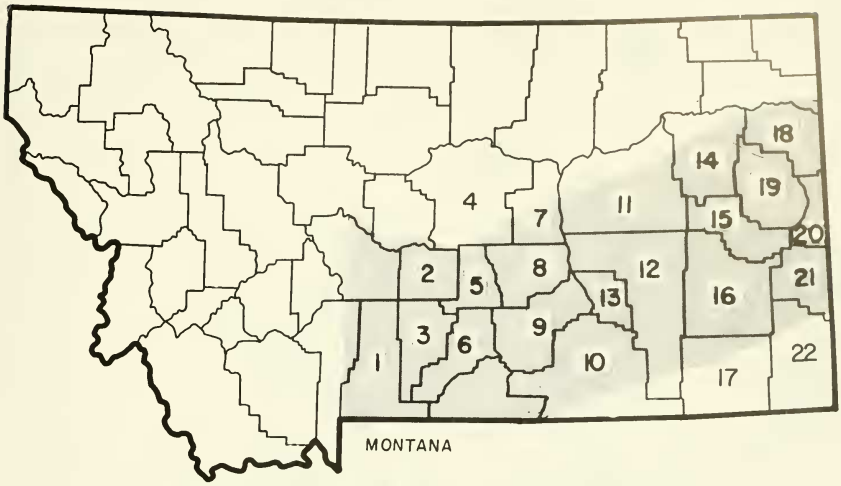
a. Ross and Hunter (1976)

TABLE 2. Number of prairie dog colonies, number of 16 ha plots occupied, total estimated area occupied by prairie dogs, and mean colony size based on Northern Pacific Railway surveys (1908–1914).

Survey year	No. prairie dog colonies encountered	No. of 16 ha (40 ac) plots occupied by prairie dogs	Estimated hectares occupied by prairie dogs	Mean colony size (ha)
1908	174	743	10,031	57.6
1909	243	539	4,656	19.2
1910	600	1,735	14,812	24.7
1911	271	547	4,934	18.2
1912	56	105	672	12.0
1913	238	574	5,000	21.0
1914	403	943	7,464	18.5
Totals	1,985	5,186	47,568	24.5

To determine the clustering of prairie dog colony distribution, we sampled two belt transects through the study area. The east-west distribution of prairie dogs was sampled along a township-wide (9.6 km) belt transect (T4N) beginning at the Montana-North Dakota border (R61E) and running west to R15E (442 km). The south-north distribution of prairie dogs was also sampled using R45E from T5S north to T21N (240 km). Although sample sizes varied by township, 31 of the 47 townships (66%) along T4N contained prairie dogs and 14 of the 28 townships (50%) along R45E contained prairie dogs. Prairie dog colonies showed a markedly clumped distribution.

We defined a prairie dog colony complex as two or more colonies, regardless of size, in adjacent sections. Some complexes covered more than 36 contiguous sections (9,216+ ha). Maps of the two largest complexes in the sampled area are illustrated in Figure 3. Not all the area in Figure 3 was surveyed, but, of that portion surveyed, extensive prairie dog colony complexes appeared closely associated with river and stream courses. Many complexes extended 16 km or more. Along the Tongue River and Otter Creek, at least 20 complexes totaled an estimated 15,000+ ha. Mean intercomplex distance was about 3.4 km (range 1–7). Along the Powder River and O'Fallon Creek, at least 33 complexes occupied a very large area (estimated 20,000+ ha). Mean intercomplex distance was about 2.9 km (range 1–4).



1 Park	7 Petroleum	13 Treasure	18 Richland
2 Wheatland	8 Musselshell	14 McCone	19 Dawson
3 Sweet Grass	9 Yellowstone	15 Prairie	20 Wibaux
4 Fergus	10 Big Horn	16 Custer	21 Fallon
5 Golden Valley	11 Garfield	17 Powder River	22 Carter
6 Stillwater	12 Rosebud		

Fig. 2. Location of the belt transect study area and counties surveyed.

Current land use in the survey area (Table 1) is for grazing livestock (78%), crop production (12%), and woodlands (9%). Other human uses (e.g., roads) represent only 1%. Land uses during 1908–1914 were probably similar to today's uses except for differences in fire suppression and cropping techniques. For example, in the past, more fires probably reduced woodlands and shrublands, thereby increasing availability of herbs and grasses for livestock use. Crop production has also changed because much cropland today is extensively irrigated with technology unavailable in the early days. Furthermore, most homesteading within the study area took place from 1915 to 1917, just after the period we examined. Range conditions, which can affect prairie dog colonization and establishment, were not definitive by modern standards for the period 1908–1914 but were generally portrayed as conducive to increasing prairie dog populations.

We estimated changes in prairie dog distribution between 1908–1914 and today. The study area crossed a large portion of Montana and included about 92,736 sq km (over 40%) of the broad range of the black-tailed prairie dog in the state. Within the study area, 17,052 sq km were sampled. They contained an estimated minimum of 475 sq km of prairie dogs during 1908–1914. Assuming prairie dogs were distributed throughout the 220,000 sq km of known Montana prairie dog range like the distribution in the survey area, then at least 6,160 sq km of prairie dogs existed in the state at that time. However, deletion of several major intrusive mountain ranges from this calculation results in a historic estimate of 5,953 sq km of prairie dogs. Surveys from 1980 to date suggest about 506 sq km of prairie dogs, a 90+% reduction.

The drastic change in the status of the prairie dog ecosystem is also apparent when

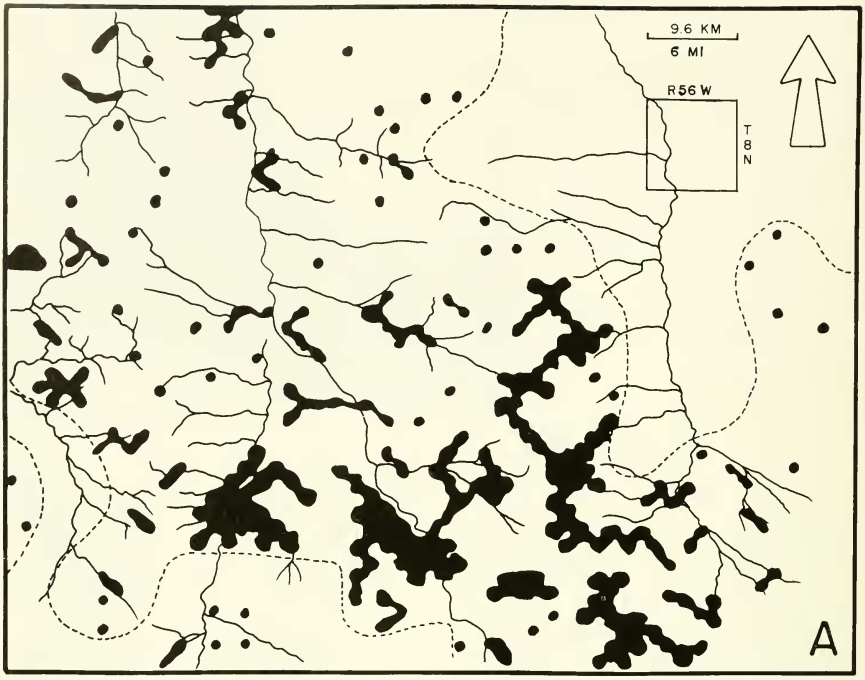


Fig. 3A. Prairie dog colony complexes in Powder River-O'Fallon Creek area, southeastern Montana (ca 1908-1914).

specific townships are compared between 1908–1914 and today. For example, one large prairie dog colony (at least 30 sections and 7,680 ha) in T4N R44E in Rosebud County 1908–1914 consisted in 1978 of only two small colonies totaling about 120 ha, only 2% of its original size. A sampling of five other townships for which specific data existed showed at least a 90+% reduction in prairie dog acreage.

Discussion

Black-tailed prairie dog colonies, with their many associated and in some cases highly dependent invertebrate and vertebrate species, formerly occupied large areas of eastern Montana. Black-footed ferrets today are considered the rarest and most endangered mammal in Montana. Most known specimens (N=44) were collected between 1915 and 1953 from 15 counties in eastern Montana (Fig. 2). Reviewed by Anderson et al. (1986), these records indicate that black-footed ferrets were widely distributed in Montana. The minimum estimated historic prairie dog range of 5,953 sq km scattered in suitable habitat over about 220,000 sq km represented a population distribution similar to that reported for other states during the 1908–1914 period (e.g., Nelson 1919, Seton 1929). Our estimates of prairie dog distribution in early Montana more closely approximate prairie dog distribution in presettlement times than prairie dog distributions seen today. Indeed, we estimate that current prairie dog distribution represents a remnant of probably 10% of the former pattern.

The greatly reduced extent of the prairie dog ecosystem resulted from poisoning campaigns that began in an organized way in 1915 under the Biological Survey and later under the U.S. Fish and Wildlife Service. No specific data were available on the annual extent of poisoning from 1915 to date for the

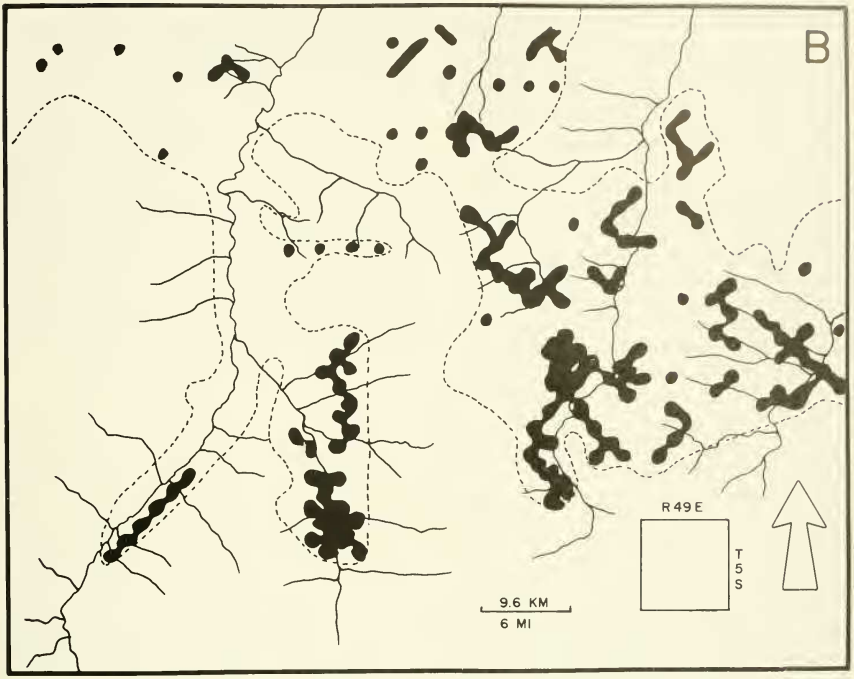


Fig. 3B. Prairie dog colony complex in Tongue River–Otter Creek area, southeastern Montana (ca 1908-1914).

study area. However, a chronological record of poisoning exists for Phillips County, just north of our study area. If Phillips County data are representative of the annual poisoning efforts for other parts of Montana, and there is every reason to believe that it is (e.g., Nelson 1919, Campbell and Clark 1981, Hubbard and Schmidt 1984), then a general chronology of reduction of the prairie dog ecosystem can be established.

The systematic poisoning program in Phillips County began in 1917. Over the next 22 years, 15,411 sq km of Richardson's ground squirrels (*Spermophilus richardsonii*) were poisoned with 168,486 kg of strychnine-soaked grain, and 69,652 ha of prairie dogs were poisoned with 34,109 kg of poison grain (Bureau of Land Management 1982). Because ground squirrels and prairie dogs often exist sympatrically, it is not possible in many cases to determine the target species for poisoning. Prairie dogs were poisoned on 27,530 ha in 1931, on 15,789 ha in 1932, and on 25,911 ha in 1933. Some of this effort was undoubtedly a second or third followup effort, but the extent of repeated poisoning of the same areas is unknown. By the end of 1933, reports mentioned that very few prairie dogs were left in the county. Limited poisoning continued until 1939, when it was felt the species was eliminated from the county. Various low-level poisoning efforts have continued irregularly to the present.

With the demise of prairie dogs went reductions in numerous other species, and the black-footed ferret serves as a dramatic example. If the black-footed ferret occurred at densities seen today in the Meeteetse, Wyoming, black-footed ferret area (1 black-footed ferret/57 ha) (Forrest et al. 1985), then at least 150,000+ individuals existed from 1908 to 1914 within the Montana prairie dog range. Direct elimination of habitat in some areas and a significant reduction and fragmentation

of habitat in other areas contributed directly to the reduction, or demise, of the black-footed ferrets. The sample areas for 1908–1914 reported in this paper along the Tongue and Powder rivers and Otter, Pumpkin, and O'Fallon creeks, for example, showed numerous prairie dog colony complexes 1.6–11.2 km apart (mean about 1.9 km). These historical Montana prairie dog areas can be compared with the existing Meeteetse, Wyoming, black-footed ferret/prairie dog complex, which is composed of 37 colonies totaling 2,995 ha (Forrest et al. 1985). Identification of this single complex recognizes that the size and distribution of black-footed ferret habitat islands is critical for the continued existence of black- footed ferrets.

Forrest et al. (1985) defined a "prairie dog complex" as a group of prairie dog colonies distributed so that individual black-footed ferrets (and their genetic material) can migrate among them commonly and frequently. Within the Meeteetse complex, mean intercolony distance is .92 km (range .13-3.70 km) and the mean black-footed ferret intercolony distance movement was 2.5 km. (5.7 maximum). Early Montana prairie dog distributions for 1908–1914 clearly fit the prairie dog complex definition of Forrest et al. (1985). Because of this, the historical Montana prairie dog situation undoubtedly served as high-quality black-footed ferret habitat. This conclusion is further supported by our understanding of black-footed ferret habitat requirements in South Dakota (Henderson et al. 1969, Hillman et al. 1979, Hillman and Clark 1980). The early Montana situation represented a habitat setting in which black-footed ferrets evolved among the complex interrelationships of species and environmental interactions of the prairie dog ecosystem. The black-footed ferret's energetics, dispersal behavior, predation avoidance, and litter production, for example, as seen in the Meeteetse black-footed ferrets, seem well suited to a universe filled with numerous, large, closely spaced, and stable prairie dog colonies like those in south central Montana from 1908 to 1914 and probably earlier.

A few areas in Montana and in other states may still contain sufficiently large prairie dog complexes to support a black-footed ferret population and serve as examples of complex, interactive prairie dog ecosystems. These areas can be compared to the existing Meeteetsee black-footed ferret habitat (prairie dog complex) as described in Forrest et al. (1985). Their value for recovery can be assessed by using a comparative black-footed ferret habitat model such as that described by Houston et al. (1986). Prairie dog areas in Montana and elsewhere should be protected, as suggested by Hubbard and Schmidt (1984), as prairie dog refuges. Black-footed ferrets should be reintroduced into appropriate prairie dog refuges once they are described, management agreements are secured, and black-footed ferrets are available for release.

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